Q1) Suppose that you have the following natural language sentences:

- I feel that you can solve these questions.
- You must think before answering question.

1. Built a suitable Context Free Grammar (CFG) and Case Grammar for the above sentences.

2. Write a prolog program to achieve the syntax and semantic (thematic) analysis for the given sentences by using the grammars that you built in step 1.

Q2) Design an expert system to classify computers (three types only) by using backward chaining according to the following properties: (processor speed, memory capacity, mother board type, and video card quality).

Q3) Consider the inference network below and then give the results of the following items:

1. Find the certainty factor for the node C4 (the implication value of each node is equal to 0.5).
2. Show the contents of WHY stack when the system asks the user about the certainty value of node e2.
3. Describe the HOW explanation mechanism when the user asks H C2. What is the system response?
Q4) What is the main goal of use the following adaptive parameters? (Choose five only)

(Fitness function, Reproduction, Momentum Term, Bias, Mutation, Activation Function, genetic Programming).

(10 marks, 2 marks for each)

Q5) Choose one branch to solve:

A) A BAM artificial neural network is trained using the following input and output patterns:

A1 = (1 1 0 0)   B1 = (0 0 1)
A2 = (1 0 1 0)   B2 = (0 1 1)
A3 = (1 0 0 1)   B3 = (0 1 0)

1- Build the weight matrix.  (4 marks)

2- Apply an input vector A3 = (1 0 0 1) to test the net to remember A3 (in one iteration only).  (6 marks)

B) Consider the following samples that are stored in a Hopfield artificial neural network:

(1 1 0 0) (1 0 1 0) (1 0 0 1), then,

1. Calculate the thresholds for all units of the input pattern.  (5 marks)

2. Build the weight matrix.  (5 marks)

Q6) In two iterations only, by using genetic algorithm approach and operators (crossover, mutation, and reproduction), try to solve the 8-puzzle problem with any initial population that you suggest.  (10 marks)

Best wishes